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Lacertids of the Mediterranean region

A Biological Approach

REPRINT

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Chapter 15

Ecological similarity of lacertid lizards in the Mediterranean region. The case of *Ophisops elegans* and *Psammodromus hispanicus*

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Introduction

Lincoln *et al.* (1982) defined convergent evolution as independent evolution or functional similarity in two unrelated or distantly related lineages that is not based on genotypic similarity. The result of this process is known as homoplasy or nonhomologous similarity (Futuyma, 1986); a common phenomenon due to the fact that different species are often subjected to similar selection pressures.

Several cases of convergent evolution have been documented from the fossil record (Futuyma, 1986) but much fewer from present day species pertaining to the same group and/or geographical area. Present day examples of convergent evolution range over a wide spectrum of taxa and habitats (Mayr, 1971) but normally involve phylogenetically distant species or groups from different continents (Karr and James, 1975; Pianka, 1986).

It has been pointed out that predictable relationships between morphology and ecology occur at the family level (Newton, 1967; Hespenheide, 1971). Convergent ecology within the lizard family Lacertidae might therefore be expected to be found in cases of homoplastic similarity between species (Arnold, 1989). In this paper, we present some preliminary information on the natural history of the poorly known lacertid lizard *Ophisops elegans*, (Darewskij and Beutler, 1981) and on its morphological and ecological convergence with the Iberian *Psammodromus hispanicus*.

Material and Methods

Data on *Ophisops elegans* were gathered during a four day (14th to 17th) field trip in April 1990 to the island of Lesvos, Aegean Sea, Hellas. Lizards were captured using rubber bands, and TBs (cloacal temperatures) were recorded within 20 seconds with a Schultheis thermometer. We also recorded, the air temperature (TA) 1 m above ground (shade), and substrate temperature (TS, shade) at the site of capture. For each individual we recorded the time of capture (solar hour). Regarding habitat and microhabitat selection, we considered four different categories of microhabitat; corresponding all of them to the "***Phrygana***" habitat in Greece, "***Matorral***" habitat in Spain, and cultivated areas in both study sites. For each animal observed, we recorded its height above ground, type of substrate, and the size of the nearest rocks or shrubs using the following categories: A: Shrubs smaller than 25 cm in height; B: Shrubs between 25 and 50 cm; C: Shrubs higher than 50 cm; D: Rocks under 25 cm in height; and E: Rocks between 25 and 50 cm.

Upon capture, a sample of 42 lizards were killed, then injected with a buffered solution of formalin and, after 24 h, transferred to 70° ethanol. For 34 of these lizards we measured (to the nearest 0.1 mm) snout- vent-length (SVL), length and width of the pileus (LP and WP, respectively), head height (HH), forelimb length (FL), hindleg length (HL) and hindfoot length (FL). We removed the digestive tract and identified prey types , to the level of order and, if intact, measured their length and width using a binocular dissecting microscope, and estimated the volume as an ellipsoid. We quantified the contribution of a prey type by calculating two indices: relative abundance (percentage of total prey numbers of a given prey type) and relative incidence

(percentage of stomachs containing a given prey type). Trophic diversity was estimated with Levins' measure of niche breath (Levins, 1968). Overlap in diet composition was calculated using the symmetrical modification of Pianka (1973) from MacArthur and Levins' (1967) measure (Krebs, 1989). We obtained comparative data of *Psammodromus hispanicus* and other Iberian lacertids from Gil (1992) as well as other published information referred to in appropriate places. We included information on the remaining Iberian ground dwelling lizard species, *Psammodromus algirus* and *Acanthodactylus erythrurus*, and the syntopic *Podarcis hispanica*, a saxicolous species with a similar body size to *Psammodromus hispanicus*. We then used the UPGMA algorithm (Sneath and Sokal, 1973) to explore diet clustering among Iberian lacertid lizards and *O.elegans* using the similarity matrix of dietary overlap values. We included in such analysis the diet of *O.elegans* from Lesvos and the spring diets of *Psammodromus hispanicus, Psammodromus algirus, Acanthodactylus erythrurus* and *Podarcis hispanica* from western Spain (Pérez-Mellado, 1981; Pascual and Pérez-Mellado, 1987; Pollo and Pérez-Mellado, 1988).

Results

Pattern and morphometric characteristics

Ophisops elegans ehrenbergii, the subspecies inhabiting Western Anatolia and Eastern Greek Islands (Darewskij and Beutler, 1981), is a small lizard (adult body length 41-55 mm; mass = 2.65 g., range:1.7-3.6 g., n=31, without significant differences between males (M) and females (F), (one-way ANOVA for body mass, F=2.62, p=0.11, in Lesvos island).

Table 1. Morphometric characteristics of *Ophisops elegans* in the two adult sex classes. SVL, snouth-vent length; LP, length of the pileus; HH, head height; WP, width of the pileus; LFL, length of the foreleg; LHL, length of the hindleg; LHF, length of the hindfoot; n, number of lizards measured.

	n	SVL	LP	HH	WP	LFL	LHL	LHF
M	17	48.28±3.0	10.68±0.66	5.44±0.34	5.15±0.38	16.17±1.37	29.06±1.9	14.17±1.03
F	17	47.57±3.1	9.74±0.38	4.94±0.27	4.6±0.36	14.4±1.22	25.4±1.5	12.66±1.13

Morphometric characteristics are similar in both sexes (Table 1). Although males seem to be slightly bigger than females, we did not find any significant difference in SVL between adult males and females (one-way ANOVA, F=0.450, p=0.514). Morphological characteristics are as follows: head

moderately depressed, snouth relatively pointed with a pronounced lanceolated concavity (see also Boulenger, 1920). Strongly keeled dorsal scales. Collar scales absent. Lesvos populations are characterized by a brown back slightly greenish in the proximal half, with two green dorsolateral stripes especially well defined in the proximal half. Stripes dorsally bordered by dark brown or black spots which extend to the end of the upper half of the tail. The pileus is uniformly brownish. Lower parts dirty white or yellowish without dark spots or marks. (Fig. 1).

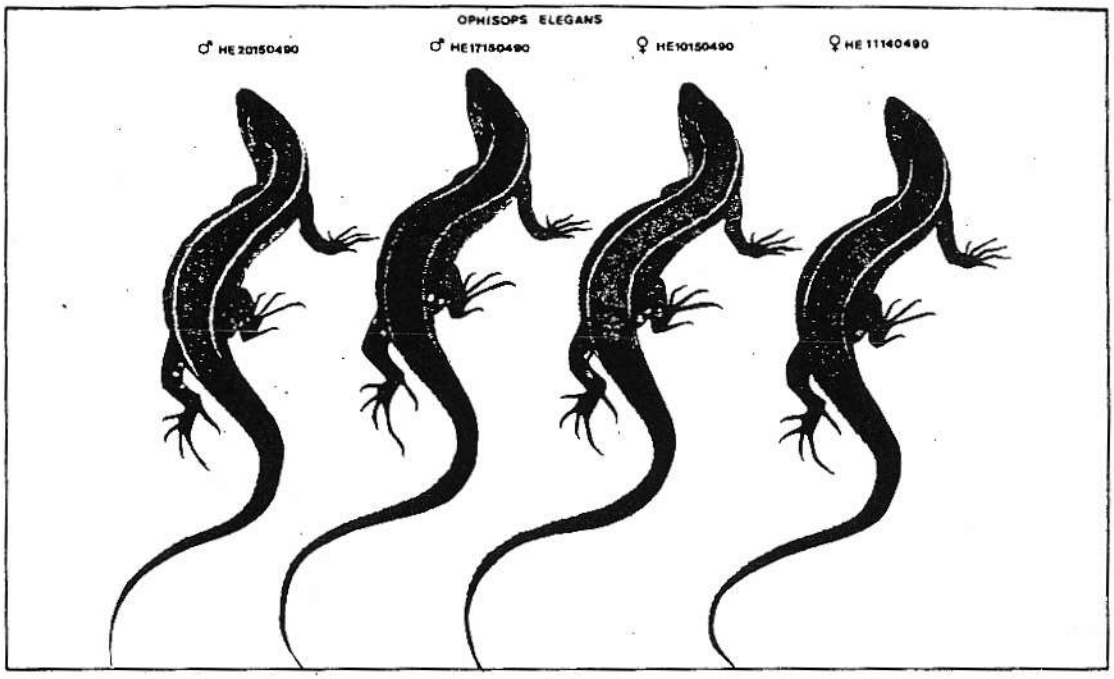

Fig. 1. Dorsal view of four adult specimens of *Ophisops elegans* from Lesvos island. See the slight individual variation in back pattern.

Habitat and microhabitat use

On Lesvos, *Ophisops elegans* is a ground dwelling lizard that was observed (n=36) in the open Mediterranean forest of *Quercus* mixed with Phrygana zones (80.55% of observations) and olive tree cultivated fields (19.44%). 31 (70.96%) microhabitat observations of *O.elegans* correspond to areas of small and medium-sized shrubs (Fig. 2).

Thermal biology

Ophisops elegans is a heliothermic lizard that uses rocks and bare ground as thermoregulatory sites. Mean body temperature of active individuals is 33.11±0.37°C (n=27) during April (sample taken from 10.45 to 14.01 solar hour in two consecutive sunny days). We did not find significant differences between adult males and females (one-way ANOVA, F=3.48, p=0.073). The poor fit of

TB on TA (ANOVA of the regression analysis, F=3.37, p=0.077) and TS (F=4.04, p=0.055) indicates precise thermoregulation in this species.

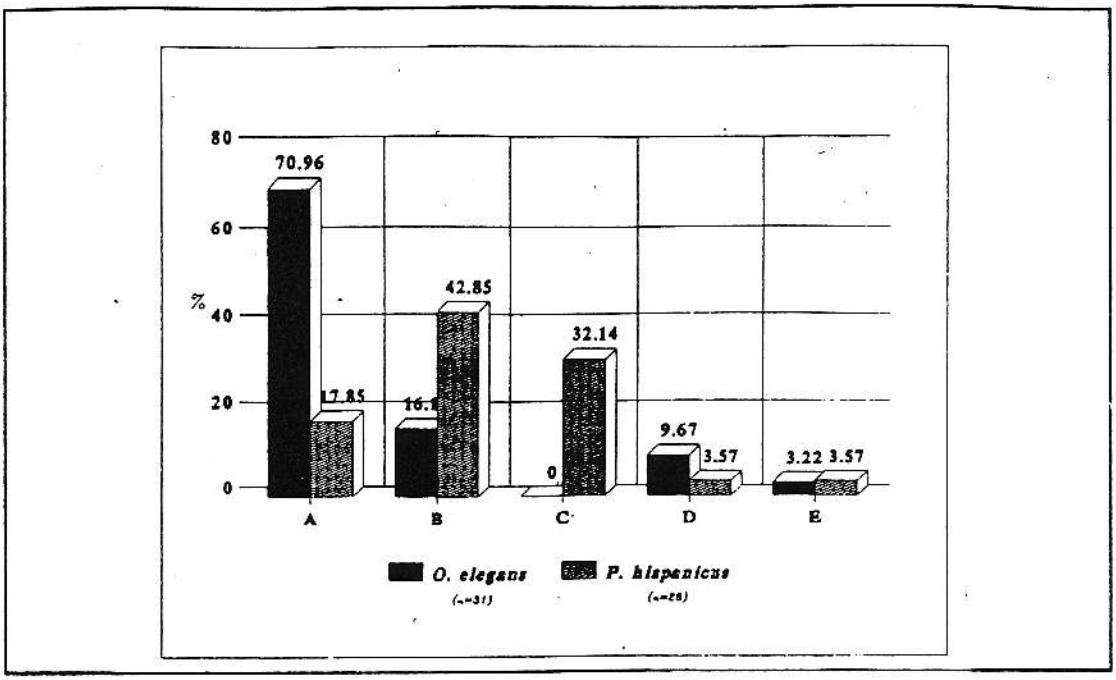

Fig. 2. Microhabitat use of *O. elegans* and *P. hispanicus*. (A: Shurbs smaller than 25 cm in height; B: Shurbs between 25 and 50 cm; C: Shurbs higher than 50 cm; D: Rocks under 25 cm in height; and E: Rocks between 25 and 50 cm).

Reproductive traits

On Lesvos in mid-April, 50% of the adult females had oviductal eggs and the remaining 50% had vitellogenetic follicles. The mean clutch size was $\bar{x}$=3.14±0.29 (n=14, range: 1-5 eggs). There was no significant correlation between clutch size and female SVL (r=0.48, p > 0.05). We found only one size class of individuals, i.e., all of them were adult specimens, as it was confirmed later from inspection of gonadal development in both sexes. Thus, *O.elegans* probably reaches sexual maturity during its first year on Lesvos.

Food habits

Araneae is the most important prey type in the diet of *Ophisops elegans* with respect to both relative abundance and relative incidence (Table 2). The relative abundance of Isoptera in adult is due to the presence of 32 prey items in one stomach (Table 2). By volume, spiders are also the most important group, followed by insect larvae and Orthoptera (Fig. 3). The main hunting strategy used by *O.elegans* is active searching for prey (unpub. data).

Table 2. Relative abundance (%R) and relative incidence (%I) of prey taxa, number of prey items, number of lizards examined, prey diversity and standardized prey diversity for *Ophisops elegans* in the overall sample and both adult sex classes.

	Males		Females		Total	
Prey taxon	% R	% I	% R	% I	% R	% I
Opilionida	1.50	9.09	0.84	5.00	1.19	7.14
Araneae	22.56	72.83	22.69	75.00	22.61	73.80
Pseudoscorpionida	–	–	0.84	5.00	0.39	2.38
Collembola	2.26	13.64	–	–	1.19	7.14
Orthoptera	5.26	18.18	5.88	30.00	5.55	23.80
Dyctioptera	0.75	4.55	–	–	0.39	2.38
Homoptera	9.77	36.36	4.20	20.00	7.14	28.57
Heteroptera	–	–	2.52	10.00	1.19	4.76
Lepidoptera	0.75	4.55	0.84	5.00	0.79	4.76
Lepid. larvae	1.50	9.09	0.84	5.00	1.19	7.14
Diptera	6.77	27.27	5.95	28.57	5.04	30.00
Formicidae	13.53	22.73	1.68	10.00	7.93	16.66
Hymenoptera	0.75	4.55	1.68	10.00	1.19	7.14
Isoptera	5.26	13.64	26.89	5.00	15.47	9.52
Coleoptera	18.80	40.91	19.33	25.00	19.04	33.33
Col. larvae	1.50	9.09	3.36	20.00	2.38	14.28
Insecta larvae	6.01	36.37	2.52	15.00	4.35	26.18
Arthopoda (undet)	1.50	9.09	0.84	5.00	1.19	7.14
No. of prey items	133		119		252	
No. of lizards examined	22		20		42	
B	7.76		5.80		7.54	
BS	0.39		0.32		0.34	

Mean prey size was 5.49±0.27 mm (n=156, range:1-16 mm), without significant differences between sizes preyed by males and females, ($\bar{x}$=5.66±0.39 mm, n=77, range: 1-16 mm; $\bar{x}$=5.60±0.40 mm, n=79, range: 2.5-16 mm, Kruskal-Wallis analysis, H=7.04, $p > 0.05$).

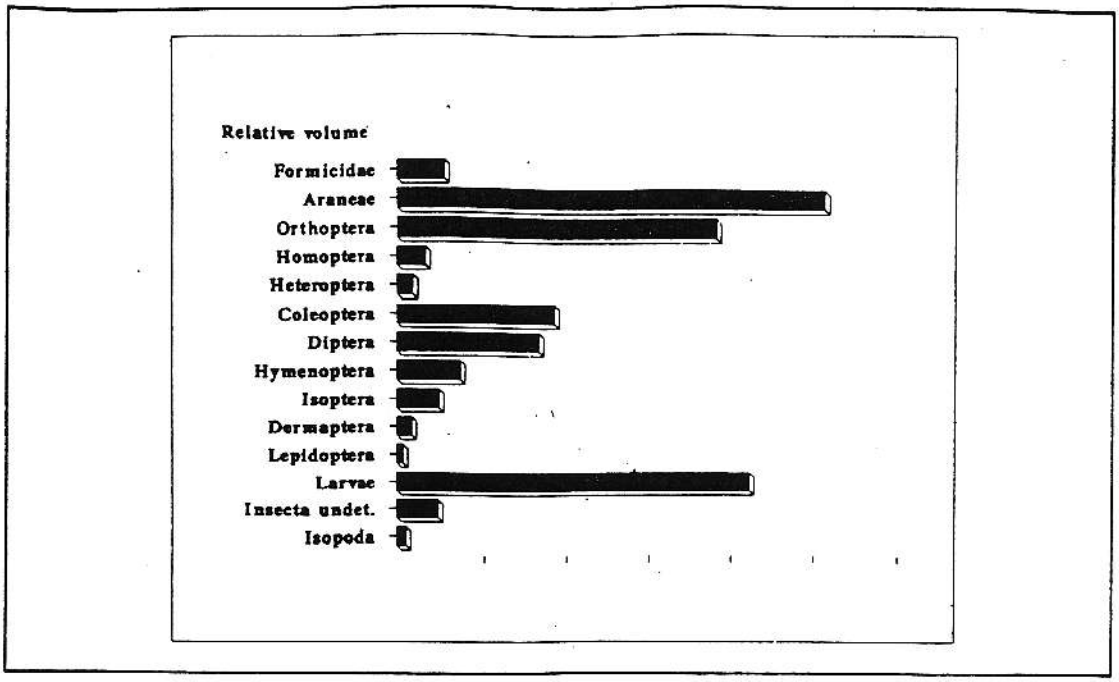

Fig. 3. Relative contribution by volume of different prey types to the diet of *Ophisops elegans* in Lesvos island.

Comparison between Ophisops elegans and Psammodromus hispanicus

P.hispanicus is also a small lizard with strongly keeled dorsal scales (adult body length 44-51 mm; see also Salvador, 1981 for morphometrics and a general description of this species). The back is greyish, brown or greenish, with four yellow to dark green longitudinal stripes interrupted by brownish or black spots (see, for example, Barbadillo, 1987 and Salvador, 1985). Adult have yellow to intense green flanks during the mating season (Barbadillo, 1987 and pers. obs.) (Fig. 4).

In both species, "concolor" mutants are not rare (Darewskij and Beutler, 1981 for *Ophisops* and Barbadillo, 1987 for *P.hispanicus*).

Comparative observations of *Psammodromus hispanicus* (n=31) correspond to open forests of *Quercus ilex* covered by a scarce shrub vegetation of ***"tomillar"*** (32.25%) and in garigues lacking tree cover (67.75%, see Gil, 1992). A similar habitat occupation was observed in other Iberian populations of *P.hispanicus* (Seva, 1982; Pérez-Mellado, 1982). The vast majority of microhabitat observations (n=28) of *P.hispanicus* corresponds to small and medium-sized shrubs (Fig. 2, Gil, 1992).

P.hispanicus, like the vast majority of Iberian lacertid lizards, is a heliothermic species with a TB ranging from 19 to 38°C in active individuals ($\bar{x}$=30.09°C, n=31 in adult and $\bar{x}$=28.94, n=53 in adult , Pollo and Pérez-Mellado, 1989).

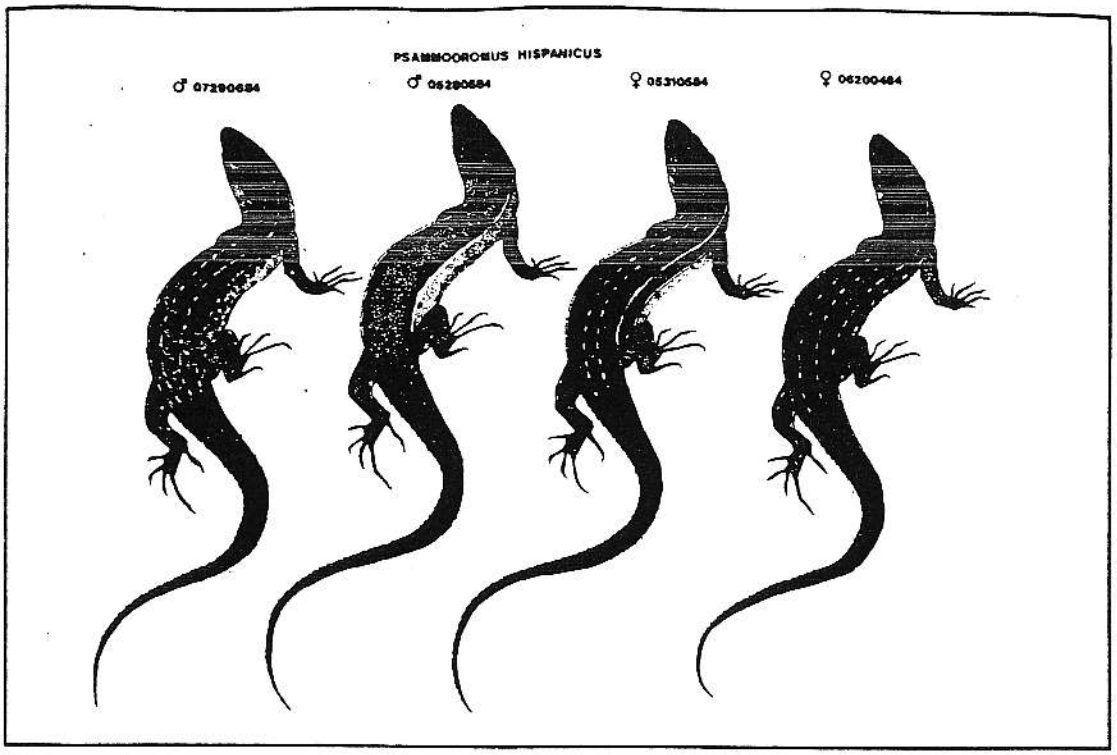

Fig. 4. Dorsal view of four adult specimens of *Psammodromus hispanicus*, 2 males and 2 females from the province of Salamanca, western Iberian peninsula.

The clutch size of *P.hispanicus* ranges between 2 and 6 eggs (Fischer, 1884; Cheylan, 1972; Pollo and Pérez-Mellado, 1990). The sexual maturity was attained also in the course of the first year of life or even less (Pollo and Pérez-Mellado, 1990).

In *P.hispanicus* , an active forager, spiders are also the most important prey type, followed by Coleoptera and Orthoptera (Pérez-Mellado, 1982; Carretero and Llorente, 1987; Mellado *et al.*, 1975; Pascual and Pérez-Mellado, 1987).

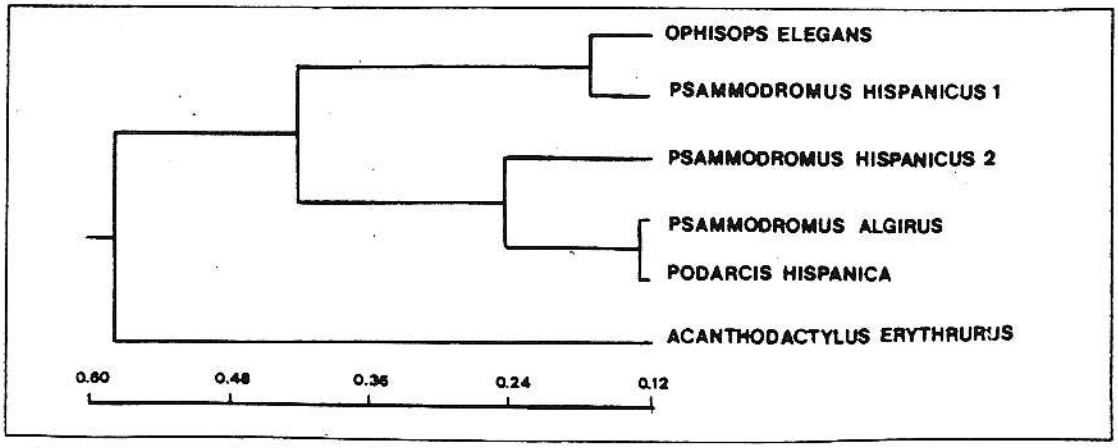

Fig. 5. Cluster analysis from the matrix of dietary overlap values of *O. elegans* from Lesvos, *P. hispanicus* from southern Salamanca province (population 1) and from the open Mediterranean forest of the centre of Salamanca province (population 2). The samples of *P. algirus*, *P. hispanica* and *A. erythrurus* are also from southern Salamanca (see text for more details).

Cluster analysis indicates greatest dietary similarity between syntopic *Podarcis hispanica* and *Psammodromus algirus* populations and between *O.elegans* and *P.hispanicus* (Fig. 5).

Discussion

Arnold (1989) conducted a parsimony analysis of the whole Lacertidae using 98 different characters and concluded that the large number of alternative trees indicates considerable homoplasy within the family. In his phylogenetic reconstruction, *Ophisops* is situated in an holophyletic section of advanced African forms, while *Psammodromus* fall into the Palaearctic and Oriental primitive assemblage. In spite of this wide separation, both species under study share several morphological characteristics such as small body size, strongly keeled dorsal scales , pointed snout, and lack of collar scales (Arnold and Burton, 1978). Thus, their general appearance is surprisingly similar. This fact was previously reported by Boulenger (1920) and Arnold (1989).

In Mediterranean scrublands, at least partially due to human intervention, increasing aridity is associated with diminishing density and a greater number of deciduous plant species. This habitat is called ***tomillar*** in Spain and ***phrygana*** in Greece (Tomaselli, 1981). Phrygana and tomillar are degradation stages of the sclerophyllous thermophilic maquis (the so-called ***matorral***, a Spanish term without exact equivalent in other languages) that Tomaselli (1981) divided by height and cover in three categories respectively. The areas occupied by *Ophisops elegans* on Lesvos and *P. hispanicus* in Spain correspond to discontinuous (cover between 50%- 75%) or scattered (25% to 50%) low (height generally under 60 cm.) matorral, with *Thymus spp.* and *Rosmarinus spp.* in the Western Mediterranean and *Sarcopoterium spinosum* in the Eastern Mediterranean as typical plant species (Le Houéron, 1981). Both species, *Ophisops elegans* and *Psammodromus hispanicus* seem to be especially common in areas characterized by intensive sheep and goat grazing (Clark and Clark, 1973; Werner, 1930; 1935 and Darewskij and Beutler, 1981). They also converge in that they use human disturbed habitats such as cultivated areas and olive tree plantations (present data; Nemenz, 1958; and Darewskij and Beutler, 1981 for *Ophisops*, and Pérez-Mellado, 1991 for *Psammodromus hispanicus*).

Spiders, and to a lesser extent beetles, are the main prey types in the diet of both species under study, they were also similarly sized (present data; Weber, 1960 and Darewskij and Beutler, 1981 for *Ophisops*, and Pérez-Mellado, 1982; Escarré and Vericad, 1983; Pollo and Pérez- Mellado, 1988 and Pascual and Pérez-Mellado, 1987 for *P.hispanicus*). We lack information on trophic availability on Lesvos, however, the consumption of Araneae by *P.hispanicus* has been shown to be high in relation to abundance (Pollo and Pérez-Mellado,

1988); indicating that a rather specialized feeding strategy is required for this food item.

In summary, *Ophisops elegans* and *Psammodromus hispanicus* are good examples of convergent ecological adaptation to life in Mediterranean open scrublands. It is possibly not the only case within these genera since Blanc (1978) described a strong morphological similarity between *Psammodromus blanci* and *Ophisops occidentalis* which are sympatric only in a narrow zone of Tunisia.

Arnold (1987) pointed out that the Iberian peninsula is characterized by the existence of two ground dwelling lizard species well adapted to Mediterranean shrub vegetation, *P.hispanicus* and *P.algirus*, the former occupying garigue vegetation with small bushy plants. There are similar habitats in continental Greece largely devoid of lizards. Following Arnold (1987), topography and climatic history could be responsible for this situation, precluding the colonization of Italian and Balkanic Peninsulas by Western Mediterranean lacertid lizards such as *Psammodromus spp.*

The genus *Ophisops* apparently appeared at the easternmost part of the Mediterranean basin from a modern phylogenetic clade which includes some species well adapted to these Mediterranean conditions. The question is why the ground dwelling adaptive habit found in *Ophisops elegans* did not allow it to extend its range over the Balkanic peninsula ? We still lack a suitable answer to this question. The recent origin of the genus *Ophisops* could be important and/or its recent expansion into eastern Greece. The existence of unknown limiting factors that preclude its geographical expansion to the Balkanic Peninsula are also possible. Only further studies on this group of species will help to resolve such biogeographical problems.

Summary

Ophisops elegans is a small lacertid lizard which was studied on the island of Lesvos, Aegean Sea, Hellas. No strong sexual dimorphism exists in pattern, coloration or morphometric characteristics. In Lesvos island it behaves as a ground dwelling lizard living in open Mediterranean forests, Phrygana habitats, and cultivated areas. It is a heliothermic species that presumably reaches sexual maturity in the course of its first year of life. The bulk of its diet consist of spiders and beetles.

Several of these morphological and ecological characteristics are convergent with those exhibited by *Psammodromus hispanicus*, a phylogenetically distant lacertid lizard from the Western Mediterranean Basin. In spite of an almost complete absence of ground dwelling lizards in continental Greece, *O.elegans* does not extend its range over continental Greece from the East.

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Literature Cited

Arnold, E. N. (1987): Resource partition among lacertid lizards in southern Europe. *Journal of Zoology, London (B)* 1:739-782.

Arnold, E. N. (1989): Towards a phylogeny and biogeography of the Lacertidae: relationships within an Old-World family of lizards derived from morphology. *Bull. Br. Mus. nat. Hist. (Zool.)* 55(2):209-257.

Arnold, E. N., Burton, J. A.(1978): *Guía de campo de los Reptiles y Anfibios de España y de Europa*. Barcelona, Ediciones Omega S.A.

Barbadillo, L. J.(1987): *La guía de Incafo de los Anfibios y Reptiles de la Península Ibérica, Islas Baleares y Canarias*. Madrid, INCAFO S.A.

Blanc, C. P. (1978): Notes sur les reptiles de Tunisie: 1. Contribution a l'étude des genres *Ophisops* Mén., 1832 et *Psammodromus* Fitz., 1826 (Reptilia: Lacertidae). *Bullétin de la Société Zoologique de France* 103(2): 143-154.

Boulenger, G. A. (1920): *Monograph of the Lacertidae*. London, British Museum (Natural History).

Carretero, M. A., Llorente, G. A.(1987). Alimentación estival de *Psammodromus hispanicus* Fitzinger 1826 (Sauria, Lacertidae) en un arenal costero del NE Ibérico. *Resúmenes del II Congreso Nacional de Herpetología*, Salamanca. p.28.

Cheylan, M.(1972): Observations sur les reptiles de la Montagne de Ste. Victoire (B. d. R.); écologie, répartition, moeurs. *Nat. Orléans* 5:13-23.

Clark, R. J., Clark, E. D.(1973): Report on a collection of amphibians and reptiles from Turkey. *Occ. Pap. Calif. Acad. Sci., San Francisco* 14:1-62.

Darewskij, I. S., Beutler, A.(1981): *Ophisops elegans* Ménétriés 1832 - Schlangenauge. In: *Handbuch der Reptilien und Amphibien Europas*, 1/I, p.461-477., Böhme W. Edit., Wiesbaden, Akademische Verlagsgesellschaft.

Escarré, A., Vericad, J. R.(1983): *Fauna alicantina. I.-Saurios y Ofidios. Alicante,* Instituto de Estudios Alicantinos.

Fischer, J. V.(1884): Der Spanische Sandschlüpfer (*Psammodromus hispanicus* Fitz.) und seine Fortpflanzung in der Gefagenschft. *Zool. Garten* 25:38-44

Futuyma, D. J. (1986): *Evolutionary Biology*. Sunderland, Sinauer Associates,Inc.

Gil, M. (1992): *Estudio de la comunidad de saurios de la vertiente meridional de la sierra de Gredos*. Ph.D. Thesis University of Salamanca.

Hespenheide, H. A. (1971): Prey characteristics and predator niche width. In: *Ecology and Evolution of Communities*, p.158-180. Cody, M. L., Diamond, J. M. Eds., Cambridge, Mass., The Belknap Press of Harvard University Press.

Karr,J. R., James, F. C.(1975): Ecomorphological configurations and Convergent Evolution. In: *Ecology and Evolution of Communities*, p.258-291. Cody, M. L., Diamond, J. M. Edit., Cambridge, Mass., The Belknap Press of Harvard University Press.

Krebs, C. J. (1989): *Ecological Methodology*. New York, Harper & Row.

Levins, R. (1968): *Evolution in changing environments. Some theoretical explorations*. New York, Princeton University Press.

Le Houéron, H. N.(1981): Impact of Man and his animals on Mediterranean vegetation. In: *Ecosystems of the World 11. Mediterranean-type shrublands*, p.479-521., Di Castri, F., Goodall, D. W., Specht, R. L. Edit., Amsterdam, Elsevier Scientific Pub. Co.

Lincoln, R.J., Boxshall, G.A., Clark, P. F. (1982): *A dictionary of ecology, evolution and systematics*. Cambridge, Cambridge University Press.

MacArthur, R. H., Levins, E. (1967): The limiting similarity, convergence and divergence of coexisting species. *Amer.Natur.* 101:377-385.

Mayr, E. (1971): *Principles of Systematic Zoology*. New Delhi, Tata McGraw- Hill Pub. Co. Ltd.

Mellado, J., Amores, F., Parreño, F., Hiraldo, F.(1975): The structure of a mediterranean lizard community. *Doñana Acta Vertebrata* 2:145-160.

Newton, I.(1967): The adaptive radiation and feeding ecology of some British finches. *Ibis* 109:33-98.

Nemenz, H.(1958): *Ophisops elegans* im Terrarium. *Aquar. Terrar.* Z. 11:215- 216.

Pascual, J. A., Pérez-Mellado, V.(1987): Alimentación de *Psammodromus hispanicus* Fitzinger, 1826 (Sauria, Lacertidae) en un medio adehesado del Centro-Oeste de la Península Ibérica. *Revista Española de Herpetología* 2:165-182.

Pérez-Mellado, V.(1981): *Los Lacertidae del Oeste del Sistema Central*. Unpub. *Doctoral Dissertation*. Universidad de Salamanca.

Pérez-Mellado, V. (1982): Estructura en una taxocenosis de Lacertidae (Sauria, Reptilia) del Sistema Central. *Mediterranea* 6:39-64.

Pérez-Mellado, V.(1991): Los Anfibios y Reptiles de la Dehesa. In: *El Libro de las dehesas salmantinas*, p.817-841. Valladolid, Junta de Castilla y León.

Pianka, E. R. (1973): The structure of lizard communities. *Ann. Rev. Ecol. Syst.* 4:53-74.

Pianka, E. R.(1986): *Ecology and Natural History of Desert Lizards. Analyses of the ecological niche and community structure*. Princeton, Princeton University Press.

Pollo, C., Pérez-Mellado, V.(1988): Trophic ecology of a taxocenosis of mediterranean Lacertidae. *Ecologia Mediterranea* 14(3/4): 131-147.

Pollo, C., Pérez-Mellado, V.(1989): Activity and thermoregulation in three mediterranean species of Lacertidae. *Herpet. Jour.* 1:343-350.

Pollo, C., Pérez-Mellado, V. (1990): Biología reproductora de tres especies mediterráneas de Lacertidae. *Mediterranea* 12:149-160.

Salvador, A. (1981): *Psammodromus hispanicus* Fitzinger 1826 - Iberischer Sandläufer. In: *Handbuch der Reptilien und Amphibien Europas, 1/1*, p.492- 502, Böhme, W. Edit., . Wiesbaden, Akademische Verlagsgesellschaft.

Salvador, A. (1985): *Guía de campo de los anfibios y reptiles de la Península Ibérica, Islas Baleares y Canarias*. León, Santiago García Editor.

Seva, E. (1982): *Taxocenosis de Lacértidos en un arenal costero alicantino. Alicante*, Servicio de Publicaciones de la Universidad de Alicante.

Sneath, P. H. A., Sokal, R. R. (1973): *Numerical Taxonomy*. London, Freeman and Co.

Tomaselli, R.(1981): Main physiognomic types and geographic distribution of shrub systems related to mediterranean climates. In: *Ecosystems of the World 11. Mediterranean-type shrublands*, p.95-106, Di Castri, F., Goodall, D. W., Specht, R. L. Edit., Amsterdam, Elsevier Scientific Pub. Co.

Weber, N. A.(1960): Some Iraq amphibians and reptiles with notes on their food habits. *Copeia* 1960 (2): 153-154.

Werner, F.(1930): Contribution to the knowledge of the reptiles and amphibians of Greece, especially the Aegean islands. *Occ. Pap. Mus. Zool. Univ. Michigan* 211:1-47.

Werner, F.(1935): Reptilien der Ägäischen Inseln. *S.ber. Akad.Wiss.Wien, Math.-Naturw.,Kl.* 144(1/2):81-117.